

SYMMETRY FESTIVAL 2016

Art&Science Programs
General Relativity 100!

18-22 July, Technische Universität Wien

www.symmetry.hu/symmetry-festival-2016/ info@symmetry.hu

The World Largest Multidisciplinary Conference & Art Festival in Symmetry Studies

Organized by **SYMMETRION**, under the auspices of the
International Symmetry Association

www.symmetry.hu

Hosted by:



TECHNISCHE
UNIVERSITÄT
WIEN
Vienna | Austria

In cooperation with:

BCSSS

**BERTALANFFY CENTER FOR
THE STUDY OF SYSTEMS SCIENCE**

Our worldwide symmetry events in the past: *Symmetry Festival 2013 Delft; SF 2009, SF 2006, SF 2003 Budapest; Symmetry Congress 1998 Haifa; SC 1995, Washington D.C.; SC 1992, Hiroshima; Symmetry of Structure Symposium 1989 Budapest.*

PROGRAMS

International Scientific Conference, including Talks and Workshops
Art Exhibits, including Contemporary Art and Origami Exhibition
Teacher Programs and Book Shows
Concerts, Performances and Movies
Family Day and Public Programs

REGISTRATION DEADLINES:

15 February 2016 – Abstract Submission

1 June 2016 – Early Bird Registration



SYMMETRY FESTIVAL 2016 VIENNA HIGHLIGHTS

Keynote and Plenary Speakers

 <p>Peter Weibel: artist, curator and theoretician. Head of the ZKM Center for Art and Media Karlsruhe</p>	<p>TBA</p>	<p>TBA</p>	<p>TBA</p>
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The keynote and plenary lectures of the **Symmetry Festival 2016** will provide a cross section of the connections between symmetry principles prevailing in different disciplines. Our hope is to provide the participants a unique forum for a novel and exciting experience that fosters mutual exchange between disciplines, between art and science, and between different human cultures.

**Symmetry Festival 2016 Vienna Music Night
GENETIC MUSIC & INTERACTIVE VISUALS**

by the Genetic Music Group of Tchaikovsky Conservatory, Moscow (www.pentagramon.com) and guest performers, including Renate Quehenberger artist and her Team

<p>Prof. Konstantin Zenkin is Vice Rector of Moscow P.I. Tchaikovsky Conservatory since 2009. He is a professional pianist and musicologist. Dr. Zenkin is the author of 4 books and more than 130 papers on various aspects of music history, music philosophy and history of piano performance.</p>		<p>Prof. Alexander Koblyakov is a dean of the Composer Faculty of the Moscow P.I. Tchaikovsky Conservatory. He is a composer, musicologist and an interdisciplinary researcher.</p>	
	<p>Ivan Soshinsky, composer and colleague of the Moscow P.I. Tchaikovsky Conservatory. Before the Moscow Conservatory he graduated Moscow M. V. Lomonosov State University as a biophysicist in 2002 and he worked as a biophysicist in the Russian Academy of Sciences.</p>	<p>Eduardo Miranda is a Brazilian composer currently working in the United Kingdom, where he is Professor in Computer Music and leader of the Interdisciplinary Centre for Computer Music Research (ICCMR) at Plymouth University. He is one of the main protagonists of Music Neurotechnology and a pioneer of using interactive biocomputing in musical composition and performance.</p>	
	<p>Renate Quehenberger is an artist and researcher living in Vienna; currently editing a book <Quantum Cinema - a digital vision> with Peter Weibel on the visualization of quantum phenomena. Besides pursuing her thesis in philosophy „On the Hermeneutics of the Penrose Pattern“, she promotes her findings, the 3D representation of the Penrose kites and darts in scientific publications and various exhibitions in museums and on math-art and film festivals.</p>		



1 INTRODUCTION: SYMMETRY FESTIVAL 2016 VIENNA

The **Symmetry Festival**, organized by the **International Symmetry Association** is an **international science and art program series** to bring together scientists, artists, educators and practitioners interested in **Symmetry Studies**. Our international symmetry movement began in 1989. Over the years, our conferences and festivals have steadily grown to become the world largest symmetry event, a major international forum to introduce the latest achievements on many scientific and artistic fields related to the phenomena of symmetry.



Photo: Nobel Laureate Sir Harold Kroto is leading a workshop for children at Symmetry Festival 2013 Delft.

The **International Symmetry Association (ISA)** has many distinguished people associated with it. They come from different countries around the world. The **Nobel Laureates Steven Weinberg/Physics, Sir Harold Kroto/Chemistry, and Gerardus 't Hooft/Physics** have given plenary lectures at **ISA** conferences and are also **Honorary Members of ISA**. Prior to receiving the **Nobel Prize in Chemistry, Dan Schechtman** (also an **Honorary Member of the ISA**) spoke at an **ISA** conference which he hosted at the Technion. **Leon Lederman, Nobel Laureate in Physics**, is on the **ISA Advisory Board**. **ISA** was also fortunate to have had the distinguished physicist, **Yuval Ne'eman**, as its **Honorary President**. Our exhibitions, concerts and cultural programs feature a large number of **internationally recognized artists, designers, musicians, dancers, writers and poets**.



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Symmetry Festival 2016 is hosted by the **Technical University Vienna**, in partnership with the **Bertalanffy Center for the Study of Systems Science**.

Symmetry Festival 2016 's program will include: (1) a **Five-Day conference**; (2) **exhibitions**; (3) **concerts, performances, and movies**; (4) a **Family Day** and **public programs** for the general audience; (5) a **SymFest 2016 Party**; and (6) an **Excursion Day**.

(1) The 5-day conference will follow the tradition of the **Symmetry Festivals**. It will consist of **plenary sessions** in the mornings and **thematic parallel sessions** and **workshops** in the afternoons. (i) The morning sessions will include **keynote speeches, invited talks** and **general lectures** on the interdisciplinary connecting role of symmetry principles. (ii) The afternoons will be devoted to **thematic paper sessions** and **workshops**.

(2) **Symmetry Festival** is organizing four kinds of **exhibitions**: (i) One of the contemporary art exhibitions will consist of works selected in accordance with the main thematic of the scientific conference and invited by the **Curatorial Team**. Another exhibition will display artworks contributed by the participants of the festival; these will be juried by the **Curatorial Team** according to the works' relevance to both the festival's main themes and their artistic level. (ii) **Models, teaching aids** related to symmetries in sciences and the arts. (iii) A special **international exhibit of origami**. (iv) Booths for **publishers, journals and books**.

(3) Evening programs will include **concerts and performances**. These will include contemporary compositions applying new symmetry principles (e.g., a genetic musical scale) and new instrumental technology for the performance. The evening programs will include **multimedia programs, movement** and **dance performances**, and **movies** related to the main themes of the Festival.

(4) The **Symmetry Festival's Family Day** invites the public to come to the conference site, meet with the scholars and artists and to participate in various events and fun programs. The public is also invited to visit the symmetry exhibitions and encouraged to interact with the exhibiting artists. **Family Day workshops and fun programs** will include **construction of artworks and models**, building **giant Zometool constructions**, playing with **modeling tools and puzzles**, and **learning-through-participation about symmetries in dance steps**. The workshops will be conducted by renowned experts in the field. **All programs are free!**

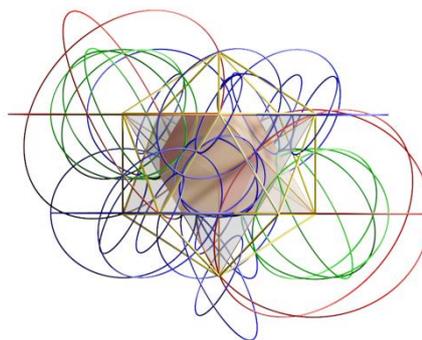
(5) Young symmetrists, students, are warmly welcome to join the **SymFest 2016 Party!** We will celebrate the rejuvenation of the symmetry movement with electronic music, DJs, and visual artists.

(6) The **Excursion Day** on **July 23** will feature a special symmetry-theme tour and several alternative options. Details and excursion ticket prices will be announced later.



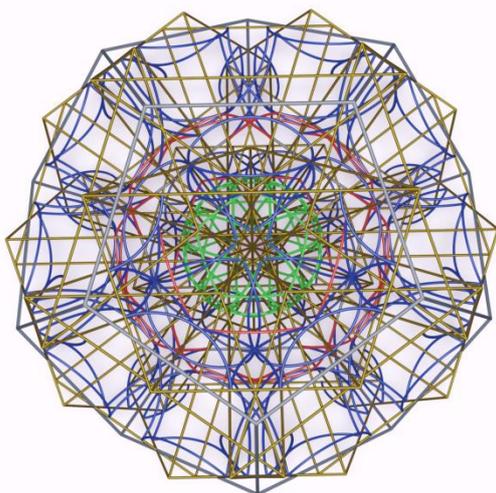
2 THE SCHOLARLY STATUS OF SYMMETRY FESTIVALS: PUBLICATION OF PAPERS AND ART CATALOGUE

Publication of Papers: Papers to be presented will be peer-reviewed before presentation and before publication. **All accepted papers will be published. Selected papers** will be published in the **printed proceedings issues of the journal *Symmetry: Culture and Science*. Other papers** will appear in the **on-line issue** of the same journal.



Art Catalogue: photos and description of artworks will be included in an electronic or printed **art catalogue** of the Festival.

3 MAIN THEMES AND TOPICS FOR SYMMETRY FESTIVAL 2016

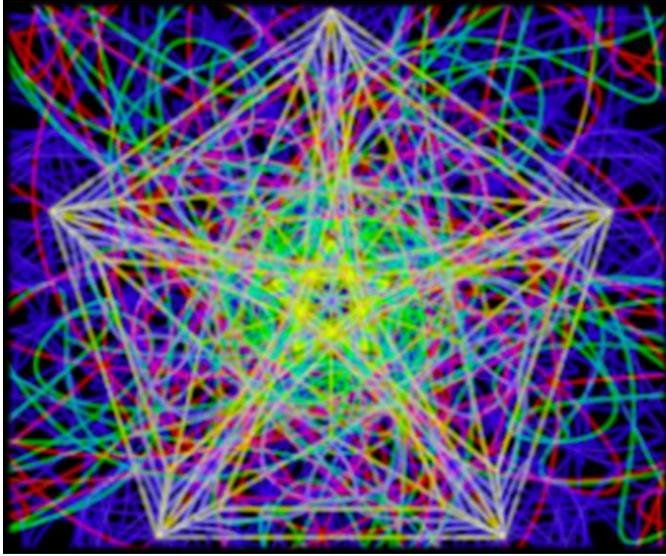


Symmetry Festivals are multidisciplinary events with a wide scope of scientific and artistic-cultural programs. The aim of such Festivals is to provide a forum for discussing phenomena, principles, and methods which cross boundaries between disciplines.

Although most emerging ideas begin in an individual discipline, at these Festivals the emphasis is laid on the extension of those ideas — including applications — to other disciplines. For example, symmetry and symmetry violation (a synthesis of

constancy and change) stimulate dialogue between disciplines. Symmetry is a property of any thing which has at least one characteristic that remains constant through change. The synthesis of that constancy along with the change embodies the “symmetry” of the given thing. An example is the repeat appearance of a square when rotated (in its plane) through 90 degrees about its center.

Symmetry Festival 2016 themes and topics will include BUT ARE NOT LIMITED TO Symmetry and Matter, Symmetry and Life, Symmetry and Interdisciplinarity in Systems Studies, Synergetics, Mathematics, Crystallography, Arts, Humanities, Education and Music!



Symmetry and Matter

At the turn of 2015-2016, the world commemorates the centenary of the general relativity theory (GTR). The relativity principle, like a few other principles of nature, is a symmetry principle, in the above mentioned sense. Over the course of hundreds of years, much of our fundamental knowledge, not only in physics, but in the sciences in general and partly in certain arts, developed along symmetry principles. At a recent stage, the structure and interactions of matter are based on the Standard Model (SM) of

physics. The Standard Model of the particles and fundamental interactions was elaborated in the 1960s by a unification of the theories of the electromagnetic and the weak interactions, and was extended in the seventies to also cover the strong interactions (electroweak and quantum chromodynamic theories). Although the Higgs mechanism — which gives an account for the origin of mass — has been incorporated, the fourth fundamental interaction, gravity, is still to be integrated to form a more unified theory. All these developments were elaborated through discoveries of new symmetry principles. More breakthroughs are expected from experiments taking place at the Large Hadron Collider (LHC), in Geneva. This machine achieved unprecedented high energies in order to test theories at the cutting edge and verify new symmetries predicted by and beyond the SM. It seems unlikely to expect any kind of new fundamental physics bypassing symmetries. Furthermore, these new developments have made an impact on other disciplines.

The history of the past sixty to seventy years contains major discoveries pertaining to the fundamental structure of matter and its interactions. Such findings were based on a consecutive sequence of discoveries of new symmetries and how they were then broken. The Standard Model is a result of that process. Although the SM (like any scientific theory) is not closed, at our present stage of knowledge it appears to be the most complete of such a theory. Attempts to elaborate more precise theories are usually based on more fundamental symmetries (e.g., so-called “supersymmetries”, combined symmetries), and would incorporate the SM as a special case. All of those theories aim at a unification of physical interactions by trying to find a common reason for their functioning.

A discussion of the sequence of symmetries and symmetry breakings also includes the investigation of asymmetries that tend to destroy our preferred image regarding the “perfection” of nature. Among others, chiral (a type of rotational/twisting) asymmetries related to the neutrino, bear far-reaching consequences at higher organizational levels; as can be seen through the history of the evolution of matter. The latter was acknowledged by the latest Nobel prize in physics.



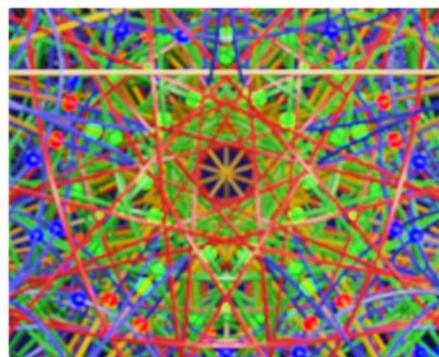
Symmetry and Life

Just as the baton of symmetry was passed, at the turn of the 20th century, from crystallography to physics, so it was also passed, at the turn of the 21st century, to the life sciences. What role did symmetry breaking play in the emergence of life and in living matter? These are hot topics of the day.

One of the main questions concerning asymmetry is: Why do the macromolecules (amino acids, nucleic acids – like RNA and DNA –, and proteins) that compose biological matter, appear dominantly in one chiral form in living beings? And why do the amino acids composing the proteins twist to the left, while DNA twists to the right? Research of the last decade enables us to obtain answers to those questions. The audience of Symmetry Festival 2016 will have an advantageous opportunity to learn about some of the latest discoveries.

The Festival also aims to satisfy the curiosity of those who wonder whether symmetry principles play any role in the genetic coding for protein synthesis. Bioinformatics, one discipline used in studying the genetic code, proceeded at an accelerated pace in the last fifteen years. In particular, there was the development of matrix genetics — matrix forms of presentation of basic ensembles of molecular elements of this code. This new mathematical approach has not only revealed surprisingly simple symmetries, but also new evolutionary regularities, heuristic analogies, and algebraic tools essential for understanding principles of formation of nucleotide (nitrogenous bases) sequence and genetic triplets (codons) in DNA which determine sequences of the twenty amino acids in proteins.

Bioinformatics of the genetic code does not only apply to geometric analogies with polyhedral and non-Euclidean space symmetries. The harmonic laws revealed in the genetic matrices are also associated with algebraic representations and generalized (hypercomplex) numbers. The analogies lead far beyond biology, through their beautiful golden-section properties and up into new features of musical harmonies.



Because symmetry plays an important role in human biology it will also play such a role in medicine. Those are subjects not only of scientific studies but are reflected in the art as well. Such domains of study were less emphasized at previous festivals. However, we are planning to give more emphasis to these studies in this and in future Symmetry Festivals.

Symmetry and Interdisciplinarity in...

Synergetics — The philosophy behind many fundamental investigations is the search for common principles — such as those common to unification theories of physics and bioinformatics. Some common principles that govern nature can be seen to come not only from symmetry proper but from synergetics as well. Those principles hold far beyond physics, and can be found in such disciplines as molecular chemistry, structural mechanics, and architecture. Their treatment involves many disciplines containing diverse approaches and methods. Investigation of symmetry breaking phenomena and their explanation are



tasks for scholars of the individual disciplines. The role of the Symmetry Festivals is to provide a forum for the discussion of the common (synergetical) principles.

Mathematics — Symmetry principles are precisely formulated through the use of mathematics. The basic tool of geometric and generalized symmetries (both of which appear in physics) is the theory of groups. A “group” is a certain type of algebraic structure defined with its own axioms. Groups seem appropriate to describe any kind of symmetry. These algebraic structures can be represented in different ways, such as through the visually illustrative set of symmetry transformations of polyhedra. Therefore, the study of symmetry properties of polyhedral can be a useful tool for all who apply generalized symmetries in the different disciplines. The inexhaustible pool of the properties of polyhedra is a rich topic of symmetry studies. These symbolic representations are applicable not only in education but also in modeling and in the interpretation of experimental and theoretical results.

Crystallography — Polyhedral models and their symmetries have been used in crystallography since the beginning of the modern study of the structure of matter. The basic notions of symmetrology were elaborated in nineteenth-century crystallography. Such notions were then borrowed, first by physics and then by the other disciplines. Crystallography, even now, plays a pioneering role in symmetry studies.

Humanities — Mathematical tools of handling symmetries enter not only in the sciences but also in the humanities. Although the humanities were earlier represented here by psychology, linguistics, and philosophy, the relatively new field of musicology has now entered the scene.

Education — has been positively effected by those developments through the study of functional asymmetries in the brain as well as research into the human cerebral hemispheres.

Symmetry in Art&Science Relations — The growing interaction between the sciences and the arts is two-way — each area influencing the other. The results of these interactions will be presented, not only in the form of talks based on papers, but also through spectacular art programs.

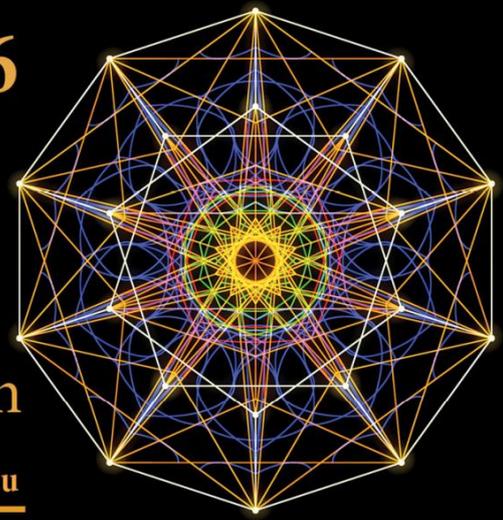
Symmetries in Music — Symmetries in music are no longer monodisciplinary studies in harmony, as they include applications of analogies borrowed from the sciences and from technological innovations. Music is more interrelated, via symmetries, with other kinds of arts than ever before.

SYMMETRY FESTIVAL 2016

Art&Science Programs General Relativity 100!

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4 REGISTRATION DEADLINES

Extended abstracts (max 4 p.): 15 February 2016

Notification on acceptance: 15 April 2016

Final papers: 15 May 2016

Early Bird Registration: 1 June 2016

Cancellation Deadline: 1 June 2016

More information on registration details will be provided soon at
www.symmetry.hu/symmetry-festival-2016





5 ORGANIZERS

Program Directors of the Symmetry Festival 2016

- Kristóf Fenyvesi, Chief Executive Officer of the International Symmetry Association
- Wolfgang Hofkirchner, Chairman of the Local Organizing Committee and Scientific Coordinator
- Renate Quehenberger, Member of the Local Organizing Committee and Art Coordinator
- György Darvas, Honorary Chief Executive Officer of the International Symmetry Association

The International Organizing Committee of the Symmetry Festival 2016 is the Executive Board of the International Symmetry Association

Executive Board	Local Organizing Committee:	Curatorial Board for Art Exhibits:
Laurence I. Gould (Chairman, USA)	Wolfgang Hofkirchner (Chairman, Austria)	László Beke (Hungary)
Banney, David (Australia)	Renate Quehenberger (Austria)	Zsuzsa Dárdai (Hungary)
Bonch-Osmolovskaya, Tatiana (Russia and Australia)	Lilian Wieser (Austria)	John A. Hiigli (USA)
Hiigli, John (USA)		Viktor Hulik (Slovakia)
Petitjean, Michel (France)		Steven Metcalf (USA)
Sugimoto, Takeshi (Japan)		János Saxon (Hungary)
		Renate Quehenberger (Art Coordinator, Austria)

The Advisory Board of the Symmetry Festival 2016 is the Advisory Board and the Honorary members of the International Symmetry Association

Honorary Members	Advisory Board	
Theo Hahn,	Sergey V. Petoukhov (Chairman, Russia)	Marijuán, Pedro C. (Spain)
Harold Kroto, (Nobel laureate)	Aerts, Diederik (Belgium)	Molnár, Emil (Hungary)
Reiko Kuroda,	Avnir, David (Israel)	Négadi, Tidjani (Algeria)
Solomon Marcus,	Bookstein, Fred (USA)	Olovsson, Ivar (Sweden)
Koji Miyazaki,	Borovkov, Victor (Japan)	Pardavi-Horvath, Martha (USA and Hungary)
Joe Rosen,	Caglioti, Giuseppe (Italy)	Petoukhov, Sergey V. (Russia)
Dan Shechtman, (Nobel laureate)	Collier, John (Canada and South Africa)	Pimenta, Emanuel Dimas de Melo (Portugal)
Meir Shinitzky,	Crowe, Donald (USA)	Ruffini, Remo (Italy)
Gerard 't Hooft, (Nobel laureate)	D'Ambrosio, Ubiratan (Brasil)	Saniga, Metod (Slovakia)
Steven Weinberg (Nobel laureate)	Deza, Michel (France and Russia)	Schulte, Egon (USA)
	Diudea, Mircea (Romania)	Séquin, Carlo (USA)
	Dunham, Doug (USA)	Tennant, Raymond (United Arab Emirates and USA)
	Elitzur, Avshalom (Israel)	Verostko, Roman (USA)
	Gerdes, Paulus (Mozambique)	Vitiello, Giuseppe (Italy)
	He, Matthew (China and USA)	Wegner, Bernd (Germany)
	Hofkirchner, Wolfgang (Austria)	Wiggs, Robert A. (USA)
	Ilgen, Fré (The Netherlands)	Zee, Anthony (USA)
	Kappraff, Jay (USA)	
	Kostov, Ruslan I. (Bulgaria)	
	Lederman, Leon (USA) (Nobel laureate)	
	Mainzer, Klaus (Germany)	

Symmetry Festival 2016 logo and featured artworks are designed and appear through the courtesy of Renate Quehenberger and FWF (PEEK) project Quantum Cinema.